PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:		)	
	Dean R. Jones et al.	)	Examiner: Robert Siconolfi
		)	
Serial No.:	10/669,226	)	Art Unit: 3683
		)	
Filed:	September 24, 2003	)	Confirmation No.: 2140
		)	
For:	SLACK ADJUSTER WITH WEAR REDUCTION	)	Attorney Docket 28679/05413

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Affidavit

I, Dean R. Jones, do hereby state:

1) I am the first named inventor of the subject matter of this application.

2) From 1995 to date I have been employed at Bendix Commercial Vehicle Systems, LLC, the assignee of this application. My present position is Senior Staff Technician.

3) In my tenure at Bendix I have been involved for about eight years with vehicle air braking systems that include automatic slack adjusters (ASAs). Bendix is an industry

leader in commercial vehicle braking systems and I am knowledgeable of the industry and its products in this area.

4) Manual slack adjusters have been on the market for many years. Their bearing material was only grease, and it was considered to be sufficient. Manual slack adjusters never had a wear ring between the worm gear and the housing.

5) Manual adjusters could be adjusted by a shop mechanic or vehicle operator using a wrench (9/16" socket), which applied a torque to the adjustment mechanism of the slack adjuster device. Any rubbing of the worm gear on the housing would not have been noticed by the mechanic during such adjustment, because its resulting frictional force would have been so much less than the amount of torque applied by the mechanic. Any increased friction or resisting force would have been relatively easily overcome by the mechanic using the leverage of the wrench. Manual slack adjusters didn't really exhibit any known failure mode of this type.

6) Automatic slack adjusters have been on the market for about 15-20 years. Their use has been required on all air brake vehicles manufactured since late 1994. Bendix is one of the world's largest manufacturers of vehicle air braking systems and components, including ASAs.

7) An automatic slack adjuster adjusts automatically by its own internal force resulting from brake application, with friction clutches and other small moving parts.

8) Over the years, some automatic slack adjusters malfunctioned and would not adjust automatically as they were supposed to. This failure of the adjuster to automatically adjust the brake stroke was dealt with by (i) mechanics manually adjusting the automatic slack adjuster (as if it were a manual adjuster) or (ii) pulling the ASA and replacing it with a new one, usually not examining it for the cause of the inoperability. The practice of manually adjusting automatic slack adjusters was

routinely practiced widely throughout the trucking industry without any further troubleshooting of any potential root cause of the automatic slack adjuster failure. This practice did not address an underlying mechanical problem in the ASAs, and likely resulted in premature wear on the adjuster. As late as March 2004 (well after the filing date of the present invention), the NTSB and slack adjuster manufacturers met to agree on language for mechanic training materials directed to discouraging manual adjustment of automatic slack adjusters indicating that this practice is not helping to solve the problem. Even at this late date, this group did not discuss any root problems, only discouraging mechanic behavior that, it turned out, masked the problem.

9) Prior to the filing date of this application the inventors of this application discovered that some automatic slack adjusters malfunction because the worm gear unintentionally engages the housing, for example because of forces applied during braking.

10) This engagement creates friction that resists rotation of the worm gear within the housing, during the automatic adjustment process. In addition, due to forces applied during vehicle braking as well as material incompatibility between the worm gear and housing, some of the housing material actually transfers to the gear causing yet additional friction. The amount of adjusting force involved within an ASA can easily be less than the resisting force of the friction between the gear and the housing. As a result, the ASA might not adjust when it should, and the driver would then complain.

11) The inventors determined or discovered that the worm gear and housing were scored and material was transferred between the parts and the gear would engage the housing enough to resist the adjustment torque, under normal usage. The torque needed for adjustment of automatic slack adjusters is much more dependent on low friction operation than that of manual slack adjusters. In addition, as the adjuster aged, the adjustment mechanism became less effective and would fail to adjust the brake stroke

at yet lower levels of resistance. Two factors were at work, increased friction between the gear and housing while the adjustment mechanism would wear and be less able to overcome even lower levels of friction resistance.

12) As a result of this discovery, prototypes of automatic slack adjusters with low friction rings were designed and tested, with the extraordinary results that are set forth in the specification of this application.

13) The slack adjusters that were tested all had the following features: a slack adjuster body having a cylindrical inner surface at least partially defining a chamber in the body; a worm gear received in the chamber in the body; and at least one low friction ring engaging the worm gear and the body and supporting the worm gear for rotation in the chamber in the body.

14) It was found that the low friction rings substantially and significantly reduce wear on the worm gear and on the body. Specifically, slack adjusters of the tested design including the low friction rings, in repeated testing, show 5 times as much useful life as those without the low friction rings. This 400% increase in useful life of the tested design of slack adjuster is attained with minimal increase in cost or manufacturing complexity compared to the overall cost of the slack adjuster.

15) In addition, the assignee of this application believes that is now commercially feasible to remanufacture slack adjusters. This is because the amount of wear experienced by the worm gear and the body is so low that a slack adjuster including the low friction rings is remanufacturable rather than having to throw the parts away.

16) Thereafter, this patent application was filed on September 24, 2003 with conception and actual reduction to practice well before the filing date.

17) Prior to this present invention, the inventors herein, and other personnel of Bendix, worked with ASAs for many years and did not discover the source of the problem.

18) In addition, I know that Bendix personnel have worked in this area for a long time, are in touch with the industry doings, and are not aware that anyone else has identified the source of the problem. Thus, to the best of my knowledge, the prior art (articles, patents, products, etc.) does not show any recognition of the source of the problem, or of a solution to the problem.

Dean R. Jones

STATE OF Ohio

COUNTY OF Lorain

Before me, a Notary Public in and for said state, personally appeared the above named Dean R. Jones who acknowledged that he did sign the foregoing instrument and that the same is his free act and deed.

In Testimony Whereof, I have hereunto affixed my name and official seal at Elyria (city), OH (state), this 2nd day of November, 2005.

Notary Public

CAROL A. PRIDDY
NOTARY PUBLIC - STATE OF OHIO
MY COMMISSION EXPIRES: 8/29/2010

(seal)